

RECENT EXPERIENCE WITH APPROXIMATE RELIABILITY-BASED OPTIMIZATION METHODS

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Traditional reliability-based design optimization (RBDO) requires a double loop iteration process [1]. The inner optimization loop is to find the most probable point (MPP) and the outer is the regular optimization loop to optimize the RBDO problem with reliability objectives or constraints. It is well known that the computation can be prohibitive when the associated function evaluation is expensive. As a result, many approximate RBDO methods, which convert the double loop to a single loop, have been developed. In this research, five approximate RBDO methods are investigated and discussed. They are: mean value method (MVM), single loop single variable or vector (SLSV) [2,3], safety factor approach (SFA) [4,5], sequential optimization and reliability assessment method (SORA) [6], and traditional approximation method (TAM). These five single loop methods were tested against a double loop method (DLM) [1], using four design problems [7,8]. The results show that with 99.87% reliability, the MVM is most effective and simple-to-code and all problems surprisingly converge despite oscillating. The SLSV is very efficient and converges nicely. The TAM, which has been implemented in some commercial software codes, converges nicely too. The SORA and SFA show promising results compared to those of DLM and provide the most stable convergence characteristics. It is noted that these two methods are virtually identical when operate in the standard normal space although their concepts are different.

It is noted that the implementation in this research is based on the authors' understanding and interpretation from literature; it may not replicate all the ideas from the original researchers.

References

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